

Weed dynamics, yield and economics in sorghum (*Sorghum bicolor*) + pulses intercropping system under rainfed condition

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ABSTRACT

A field experiment was conducted in red sandy loam soils during the rainy season 2000 and 2001 at Regional Research Station, Paiyur, to study weed dynamics, yield and economics in sorghum [*Sorghum bicolor* (L.) Moench] + pulses intercropping system under rainfed condition. The treatments consisted of recommended practice of sorghum (pure crop) with atrazine @ 0.25 kg a.i./ha and sorghum intercropped with cowpea [*Vigna unguiculata* (L.) Walp.], blackgram (*Phaseolus mungo* L.), and greengram (*P. radiatus* L.) without and with pre-emergence herbicide metolachlor 1.0 kg a.i./ha. Application of atrazine @ 0.25 kg a.i./ha in pure crop of sorghum and metolachlor @ 1.0 kg a.i./ha in intercropping system controlled the weeds effectively compared to no-herbicide application. Application of metolachlor increased the mean sorghum grain yield by 54, 48 and 47% and pulses grain yield by 48, 38 and 27% in sorghum + cowpea, sorghum + blackgram and sorghum + greengram intercropping, respectively, compared to no-herbicide application. The higher net income (Rs 10,759) and benefit : cost ratio (3.16) were recorded in sorghum + greengram with metolachlor application than other intercropping system.

Key words : Sorghum intercropping, Weed control, Yield, Economics

Sorghum is an important coarse cereal of tropical climate, grown mostly under rainfed and raisky condition in fertility, depleted and water-deficit soils of arid and semi-arid regions of India. In north-western agro-climatic zone of Tamil Nadu, nearly 77% of the total cultivable area is under rainfed farming and sorghum occupies major area with pulses as intercrops. Intercropping is a potential agronomics system for maximizing crop production on drylands over space and time in subsistence farming situation besides effective utilization of natural resources (Willey, 1979). Weed control is a greater problem in intercropping than sole cropping. Though manual weeding is a predominant method, the availability of labour and its cost pose the major problem in controlling the weeds in intercropping situation (Palaniappan, 1985). In recent past, the chemical weed control plays vital role in controlling weeds effectively besides increasing yield and net income. However, the herbicides are crop specific and hence available herbicide should control a broad spectrum of weeds without causing damage to component crops in intercropping situation. Hence an attempt was made to study the effect of herbicide on weed dynamics, yield and economics of sorghum + pulses intercropping system under rainfed condition.

MATERIALS AND METHODS

The field experiment was conducted at Regional Research Station, Paiyur, during rainy seasons of 2000 and 2001 under rainfed condition. The soil was red sandy loam in texture with available N, P and K of 296, 9.2, 292 kg/ha, respectively, with soil pH of 7.4. The treatments consisted of recommended practice of sorghum (pure crop) with atrazine @ 0.25 kg a.i./ha (T_1) and sorghum intercropped with cowpea (T_2 and T_3), blackgram (T_4 and T_5), and greengram (T_6 and T_7) without and with pre-emergence herbicide of metolachlor 1.0 kg a.i./ha. The experiment was laid out in randomized block design with 3 replications. The varieties used were sorghum 'Co 26', cowpea 'Paiyur 1', blackgram 'CBN 3' and greengram 'Paiyur 1'. The spacing adopted was 45 cm × 15 cm and (30+60) × 15 cm (paired row system) for pure and intercrop respectively. The total rainfall received during the cropping period was 625.8 and 497.5 mm in 32 and 30 rainy days during rainy season 2000 and 2001 respectively. The recommended N, P and K dose was 40, 20 and 0 kg/ha and entire quantity was applied as basal. The herbicide was applied 3 days after sowing (DAS) when moisture was available adequately.

RESULTS AND DISCUSSION

Effect of weeds

The common weeds found in the experimental field were *Trianthema portulacastrum*, *Cyperus* spp., *Fimbristylis argentea*, *Eragrostis plumosa*, *Dactyloctenium aegyptium*, *Commelina bengalensis*, *Borreria hispida*, *Celosia argentea*, *Euphorbia hirta* and

Boerhaavia erecta.

In both the years, the numbers of weeds and dry weight of weeds were significantly influenced by the application of herbicides (Table 1). Application of metolachlor @ 1.0 kg a.i./ha on 3 DAS in sorghum intercropped with cowpea or greengram or blackgram showed less number of weeds compared to no application of herbicide. Application of

Table 1. Effect of weed-control treatments on weed dynamics, growth characteristics of component crops in sorghum + pulses intercropping system under rainfed condition

Treatment	Weeds dynamics				Sorghum				Pulse					
	No. of weeds (No./m ²)		Weed dry weight (g/m ²)		Ear weight (g)		Test weight (g)		Pods/ plant		Seeds/ pod		Test weight (g)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
T ₁ , Sorghum (pure) with atrazine @ 0.25 kg a.i./ha	1.76 (60.7)	1.69 (57.7)	1.61 (42.5)	1.57 (42.2)	62.3	64.7	2.40	2.47	-	-	-	-	-	-
T ₂ , Sorghum + cowpea	2.52 (332.0)	2.12 (157.3)	1.65 (49.9)	1.85 (81.3)	50.1	47.6	2.13	2.23	8.3	15.6	11.3	11.9	10.2	10.4
T ₃ , Sorghum + cowpea with metolachlor @ 1.0 kg a.i./ha	1.64 (47.3)	1.24 (18.3)	1.49 (37.5)	1.23 (13.6)	54.4	59.0	2.33	2.43	9.6	15.4	14.7	14.5	11.0	10.9
T ₄ , Sorghum + blackgram	2.64 (443.3)	2.17 (154.3)	1.89 (78.0)	2.01 (103.9)	41.1	47.6	2.07	2.23	23.2	21.8	7.1	6.5	4.9	4.5
T ₅ , Sorghum + blackgram with metolachlor @ 1.0 kg a.i./ha	1.69 (52.0)	1.46 (34.7)	1.53 (35.4)	1.32 (26.2)	46.2	66.4	2.47	2.60	36.5	21.3	7.7	6.9	5.0	5.2
T ₆ , Sorghum + greengram	2.51 (329.3)	2.22 (168.3)	1.78 (62.8)	2.00 (106.3)	38.9	49.9	1.97	2.27	33.5	26.2	12.2	12.7	3.4	3.4
T ₇ , Sorghum + greengram with metolachlor @ 1.0 kg a.i./ha	1.80 (65.3)	1.40 (26.3)	1.45 (28.0)	1.12 (19.4)	51.8	64.3	2.53	2.53	36.6	35.6	12.9	12.9	3.9	3.6
CD (P=0.05)	0.29	0.37	NS	0.56	NS	9.8	NS	0.26	NA	NA	NA	NA	NA	NA

Table 2. Effect of weed-control treatments on yield and economics in sorghum + pulses intercropping system under rainfed condition

Treatment	Sorghum grain yield (kg/ha)		Sorghum stover yield (kg/ha)		Pulses yield (kg/ha)		Sorghum grain equivalent*		Gross income (Rs/ha)		Net income (Rs/ha)		Benefit : cost ratio	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
T ₁ , Sorghum (pure) with atrazine @ 0.25 kg a.i./ha	1,507	1,285	2,863	4,880					8,175	8,800	4,152	4,777	2.03	2.19
T ₂ , Sorghum + cowpea	889	762	1,682	3,250	670	580	1,005	870	8,838	8,966	4,880	5,008	2.23	2.27
T ₃ , Sorghum + cowpea with metolachlor @ 1.0 kg a.i./ha	1,389	1,155	2,642	4,475	945	860	1,481	1,290	13,208	13,136	8,290	8,218	2.68	2.67
T ₄ , Sorghum + blackgram	975	835	1,852	3,525	384	345	960	863	9,129	9,434	5,131	5,436	2.28	2.36
T ₅ , Sorghum + blackgram with metolachlor @ 1.0 kg a.i./ha	1,455	1,215	2,778	4,525	520	483	1,300	1,208	13,104	13,084	8,146	8,126	2.64	2.64
T ₆ , Sorghum + greengram	967	835	1,821	3,541	524	493	1,572	1,483	11,522	11,912	7,504	7,894	2.86	2.96
T ₇ , Sorghum + greengram with metolachlor @ 1.0 kg a.i./ha	1,432	1,215	2,714	4,525	672	616	2,016	1,850	15,828	15,646	1,085	10,668	3.17	3.14
CD (P=0.05)	103	59	726	180	NA	NA	156	131	NA	NA	NA	NA	NA	NA

Cost of produce (Rs/kg): Sorghum 4, cowpea 6, blackgram 10, greengram 12

atrazine @ 0.25 kg a.i./ha in pure crop of sorghum recorded significantly less number of weeds compared with no application of herbicide in sorghum intercropping system in both the years. However, application of metolachlor in intercropping system greatly reduced the number and dry weight of weeds compared with atrazine (in pure crop sorghum) and no herbicide application in intercropping situation. This may be because of effective control of weeds by the metolachlor besides smothering effect of pulses on weeds in sorghum + pulses intercropping systems in both the years. This was in accordance with Boobathi Babu (1978) wherein alachlor 1.5 kg a.i./ha as pre-emergence application gave good weed control in intercropping system.

Effect on yield

In both the years grain yields of sorghum and pulses were significantly higher with the application of herbicide, viz. atrazine for pure crop and metolachlor for intercrop (Table 2). The pure crop of sorghum with atrazine @ 0.25 kg a.i./ha recorded the highest grain yield. Though the sorghum grain yield in intercropping system was comparatively lower than sorghum pure crop, the additional advantage of pulses yield was realized in intercropping situation. Application of metolachlor increased the sorghum grain yield 54, 48 and 47% and pulses seed yield by 45, 38 and 27% in sorghum intercropped with cowpea or

blackgram or greengram, respectively, over no application of herbicide. Solaimalai and Mathusankaranarayanan (2000) also reported similar findings.

Effect of monetary returns

Intercropping of sorghum with pulses registered the higher net returns and benefit : cost ratio than pure crop of sorghum (Table 2). Among the intercropping system, application of metolachlor registered higher net income and benefit : cost ratio than no application of herbicide. The sorghum intercropped with greengram, cowpea and blackgram applied with herbicide registered higher net income of Rs 10,759, Rs 8,254 and Rs 8,136/ha with the benefit : cost ratio of 3.15, 2.68 and 2.64 respectively. The pure crop of sorghum registered only Rs 4,465 with benefit : cost ratio of 2.11.

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